Teacher Education Tutors' Practice in ICT: North and South

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1 Introduction and Background

The place of ICT in teaching and learning continues to be fundamental, especially in knowledge-based economies. However, relatively little recent work has been done on the perceptions of Initial Teacher Education tutors' understanding of the role of ICT in the professional education of student teachers. Some may see their role as 'functionalist', preparing student teachers to use ICT within current school requirements. Others may consider their role more strategically to include a critique of existing policies and practice while in some instances, tutors may regard their role as 'transformative' by enabling students to support new ways of learning through embracing highly innovative approaches (Hadyn, 2014, Haydn & Barton, 2008). However, to what extent are these 'models' or paradigms evidenced in the pedagogy of the ITE tutor? To date little empirical evidence exists for Northern Ireland (NI) and the rest of Ireland to address this question, nor have other models of practice been identified.

In all teacher education institutions on the island of Ireland, tutors, whether they have a strong background in ICT or not, are expected to embed ICT in the work they do with student teachers and in the way they prepare these students for the classroom. For over a decade research has revealed concerns about pre-service course preparation to use technology effectively in the classroom (CEO Forum on Education and Technology, 2000) ranging from a lack of time to experiment with the new technologies (Wepner *et al.,* 2003), a technological skills deficit and/or fear of technological problems (Eifler *et al.*, 2001), to a lack of access to new technologies or a mismatch between the tutor's own teaching philosophy and that of their institution (Dexter & Riedel, 2003). Many of these findings were confirmed by the OECD report into the role of ICT in Initial Teacher Training (2010). Using data from nine different countries, including the United Kingdom (UK), the report noted that previous research by Enochsson & Rizza (2009) suggested that ICT was not used in teacher training regularly or systematically in the countries reviewed. Among the reasons cited for this were a lack of positive role models at the teacher training institution as well as on school placement, a lack of confidence in teacher tutors' own ICT skills, (both technical and pedagogical), a lack of reliable equipment at schools and difficulty in accessing the equipment at all times.

Ananiadou & Rizza's OECD report also commented on the potential influence of the tutor in shaping student teachers' attitudes towards ICT. It claimed that ITE providers can be important role models suggesting that in many countries student teachers saw tutors modelling the creative use of ICT in their practice as being a critically important part of their training. According to the report,

> 'this emerged as one of the important variables in terms of the development of student teachers' pedagogical capability in ICT. In the student responses to the online questionnaire in the United Kingdom (England) for example, only 28% of student teachers described their tutors' confidence in using ICT as 'very good'. Another variable was student teachers' views of the importance attached by their tutors to the role of ICT development in the course, with 77.5% reporting this as either important or very important. Trainer confidence and expertise was also thought to be an important variable in other countries.' (Ananiadou & Rizza, 2010, 05625)

This finding challenged previous research notably by Baumberger, Perrin, Betrix, & Martin (2008), Judge & O'Bannon (2008) and Whittier & Lara (2006) which suggested that tutor confidence was not always

critical in student-teacher development of ICT. In addition to the personal and institutional factors discussed, the specific country in which tutors work and the wider schooling context within which ICT is located needs to be considered.

Austin and Hunter (2013) in their analysis of ICT policy on the island of Ireland and in Canada, noted the very marked differences between ICT policy application between Northern Ireland and the rest of Ireland. Where Northern Ireland's policy was driven by a centralised ICT strategy for every school, backed up with mandatory teacher training and pupil assessment, the Department of Education and Skills (DES) in Dublin was far more inclined to promote a 'bottom-up' approach with schools being given wide scope for ICT development. In the case of the assessment of ICT, Northern Ireland requires (by law since 2016) that all children aged between 5 and 14 present evidence of their competence in the use of ICT. At present, there is no similar provision on the other side of the border.

The result of this has been that teacher trainers in Northern Ireland can build their approach to ICT in the knowledge that all schools that accept student teachers have a guaranteed core of hardware, software and internet access which is regularly maintained and refreshed every five years. Marshall & Anderson (2008) note that, while there is policy on ICT in education in the Republic of Ireland, the information on its implementation is limited, or that some policy documents fail to get published. The result is a lack of clarity about the impact of policy targets 'throughout all levels of the system' (2008, 464). Even these limited initiatives seem to have had little impact. They note that the '... 2005 census on ICT infrastructure in schools [in the Republic of Ireland] paints a bleak picture' (2008, 467) and conclude that, despite improvements to computing resources in schools, '…it seems that Ireland lags behind other countries…' (2008, 468). They cite OECD evidence which suggests that the Republic of Ireland is below the average across OECD countries in terms of pupil to computer ratios, and in measures of networking and connectivity. Marshall and Anderson contrast this with the situation in Northern Ireland, at least at the time they were writing, which had made considerable investment in ICT, including in connectivity and teacher training.

Student teachers in the 21st century have few qualms about using technology and therefore one of the main challenges existing today for the Initial Teacher Education (ITE) tutors is to maintain pace with the advancement of new technologies and also to support and guide student teachers in how to effectively manage and use technology for **pedagogical** purposes. The recent demographic change in ITE tutors in higher education creates a timely opportunity to explore how ITE tutors cope with the challenges and expectations of the 21st-century learner in ITE and how they manage their own technological and pedagogical development as a lecturer.

In examining ITE tutor's use of ICT we have drawn upon a matrix developed by UNECO (2011) to assist teachers in reflecting on how they deploy technology in education. The *UNESCO ICT Competency Framework for teachers* (Figure 1) provided us with a comprehensive and progressive way of studying ITE tutors' perceptions and experiences of ICT. In addition, we have been influenced by the work of Alan November (2018) whose early work as far back as 1998, outlined how some uses of ICT were simply 'automating' learning by accelerating what learners did, while other instances of ICT-enabled learning could be described as either 'enhancing' learning or at its best 'transforming' it with impact beyond the school/institutional setting. In his most recent work, on embedding technology in the classroom, November explores five levels of technology integration that moves from simply automating current student products to transforming them through critical thinking, collaboration, developing audience and building legacy worldwide.

THE UNESCO ICT COMPETENCY FRAMEWORK FOR TEACHERS			
	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
UNDERSTANDING ICT IN EDUCATION	Policy awareness	Policy understanding	Policy innovation
CURRICULUM AND ASSESSMENT	Basic knowledge	Knowledge application	Knowledge society skills
PEDAGOGY	Integrate technology	Complex problem solving	Self management
ICT	Basic tools	Complex tools	Pervasive tools
ORGANIZATION AND ADMINISTRATION	Standard classroom	Collaborative groups	Learning organizations
TEACHER PROFESSIONAL LEARNING	Digital literacy	Manage and guide	Teacher as model learner

Figure 1: UNSECO ICT Competency Framework for Teachers
(Source: http://unesdoc.unesco.org/images/0021/002134/213475E.pdf)

2 Methodology

The research strategy employed in this study was an exploratory convergent mixed methods design (Essling *et al.*, 2017, Creswell, 2014, Creswell *et al.*, 2011) that used qualitative and quantitative methods to explore Initial Teacher Education (ITE) tutors' perspectives on the challenges and expectations of the 21st-century learner in ITE. In addition it explored how ITE tutors manage their own technological and pedagogical development (Figure 2).

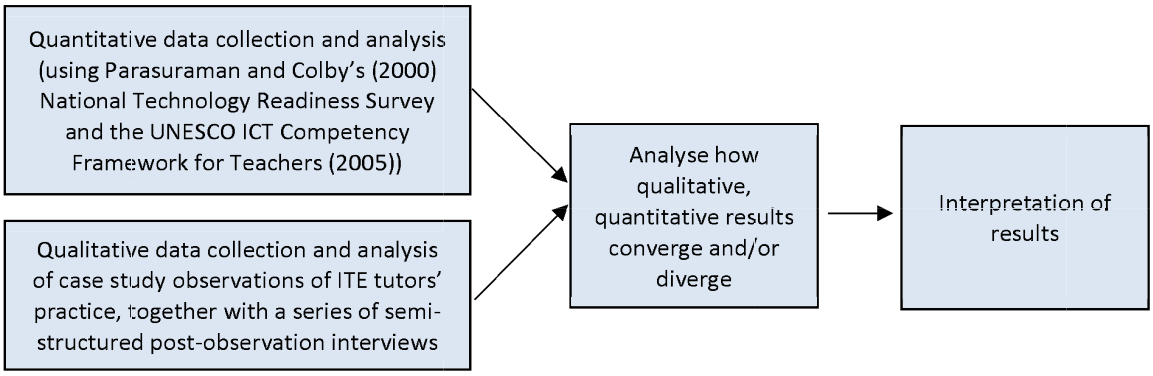

Figure 2: Exploratory convergent mixed methods design used in the study

The research consisted of four distinct phases.

Phase 1: Survey

Using Parasuraman and Colby's (2015) *National Technology Readiness Survey* and the *UNESCO ICT Competency Framework for Teachers* (2005) this phase of the study consisted of the development, distribution and analysis of a survey that was administered to ITE tutors. The survey sought to explore the following:

1. The benefits and challenges for ITE tutors when using ICT in teacher education
2. The technologies used by ITE tutors in preparation for teaching and learning
3. The use of technology in teaching
4. The perceived value of technology in ITE teaching and learning

The questions used in this survey consisted of a series of open and ordinal bipolar responses (e.g. strongly disagree, disagree, indifferent, agree, agree strongly) in response to a series of statements relating to the use of ICT in ITE (Appendix A). These statements received a score of, e.g. 1, 2, 3, 4, 5, respectively, for bi-polar response alternatives. These scales did not apply to questions that provided nominal data asking for yes/no responses.

Before distribution, a pilot study of the survey was carried out by each of the authors in their respective institutions. In total, eight ITE tutors were asked to participate in the pilot study, and the responses and comments made in relation to the content, layout and how the questionnaire should be administered were then incorporated into the final questionnaire revisions. The survey was then distributed to eight ITE institutions on the island of Ireland with the prior consent of the relevant Heads of School. Only those ITE tutors whose core role was perceived to be pre-service education were invited to participate. Following the judicious use of reminders, 37 fully completed responses were received for analysis using SPSS verison 22.0. The reliability of the 'Readiness' subscales of *Optimism*, *Innovativeness* and *Discomfort* had Cronbach's alpha coefficients of 0.904, 0.888 and 0.818 respectively.

Phase 2: Observations

To further explore the use of ICT by ITE tutors and their students a series of semi-structured lecture observations were completed across the seven of the eight participating institutions on the island.

While we cannot disconnect completely our underpinning values and beliefs from the ways we interpret a situation, the significant challenge for educational researchers 'is to acknowledge and overcome our personal interpretations by a variety of means, not least of which is using our professional knowledge as researchers to ensure clarity of concepts, purpose and method both before and after observational data-collection' (Moyles, 2007). With this statement in mind, different forms of observation (structured, unstructured, semi-structured) together with their associated data-collection techniques were considered. It was ultimately decided that a semi-structured observation would best suit the goals of the study. The concept of 'semi-structured' observation might need a little explanation. Moyles (2007) argues that 'observation is either structured or unstructured' (ibid) for example. In the context of this study, the structured part of the observation had a pre-determined purpose and focus which was to explore the use of ICT by ITE tutors and students during the course of a series of two-hour lectures in ITE institutions. The unstructured part of the observation was that there were no 'Likert type' scales used to gather data about the participant being observed but rather to observe and document emerging themes on the use of ICT that are not described in Parasuraman and Colby's (2015) National Technology Readiness Survey and the UNESCO ICT Competency Framework for Teachers (2005).

It was also noted that using semi-structured observations (as opposed to using a more structured approach) for gathering data could reduce the reliability and validity of the data if the necessary data required for the study was not gathered. However, Le Compte and Preissle suggest that the reliability and validity of the observation can be enhanced by keeping in mind a series of questions that need to be answered such as: 'Who is in the group; what is being said and by whom; What appear to be the significant issues that are being discussed, What non-verbal behaviour is taking place, When and where is the event occurring and at what time, etc.' (1993, p.199). These questions formed the foundations for what was deemed to be essential data that needed to be gathered if the observation was to be considered authentic and trustworthy.

Data Analysis

Using the *UNESCO ICT Competency Framework for Teachers* (2005), the researchers developed a typology of dominant behaviours and interactions with ICT that emerged during the observations. The development of a typology is centred around the classification of entities into groups based on their similarities and is one of the most generic of all theoretical exercises. According to Bailey (1994), 'without classification, there would be no advanced conceptualisation, reasoning, data analysis or, for that matter, Social Science research' (p.2). Indeed, the importance of using a typology for analysis can also be summed up by Doty and Glick (1994) who state that 'typologies are essential to clear and parsimonious understanding of organizational phenomena' (p.234), and in the case of this study, the phenomena being studied is that of the use of ICT by ITE tutors and students in a real-world setting.

The second stage of the analysis involved a dual process of data immersion/crystallization which according to Borkan (1999) 'provides a means to move from the research question, the generated text and/or field experience, and the raw field data to the interpretations reported in the write-up' (p.180). Having gathered the relevant data for analysis the field researchers *immersed* themselves in the data collected by reading, re-reading and examining the transcriptions in detail until thoroughly familiar with it. This step was then followed by an attempt to crystallise the data to reflect on the analysis and to identify and articulate patterns or themes noticed during the immersion process. This dual process continued until all the data had been analysed and dominant patterns of ICT use began to emerge.

The next stage involved open coding of the data by assigning each of the ITE tutor and student statements/behaviours with an appropriate label that represented the central aspect of teaching and learning using ICT.

The final stage of the analysis involved a process of axial coding which sought to analyse and link the results of the observation with the concepts and insights that had emerged in the course of the literature review.

Phase 3: Interviews

Following the development of an interview schedule (Appendix B), twelve one-hour interviews were conducted with ITE tutors from February to May 2017. Selection of participants was based on an open invitation that was sent to the eight ITE institutions involved in the Phase 1 survey. Semi-structured interviews were deemed to be the most appropriate type of interview for this study (Creswell 2014) and allowed the researchers to keep a focus on the overarching theme of the research while at the same time allowing them to explore certain responses in more detail. Furthermore, the researchers were also of the view, in agreement with Miles, Huberman and Saldaña (2013), that the power of the analysis can be reduced if interviews are not focused as 'too much superfluous information will be collected. An

overload of data will compromise the efficiency and power of the analysis' (p.39).

The interview coding and analysis framework of this phase of the research used Creswell's (2008) data analysis process and Miles and Huberman's (1994) *Components of Data Analysis: Interactive Model* and consisted of three analytical stages (transcription of interviews, data immersion and coding and analysis). All interviews were thematically coded using NVivo 10 Software.

Phase 4: Convergent Phase

Finally, phase 4 of the study consisted of converging the previous phases to form an overall interpretation of the data as reported in the findings section of this paper.

3 Presentation and Analysis of Results

The overarching aim of the study was to establish a 'snapshot in time' of teacher educators' use of technology in their teaching, how they address their own continued professional development needs as 21st Century educators as well as the needs of ITE students. Presentation and analysis of qualitative and quantitative results are described according to: (1) participant profiles; (2) teacher educators' attitudes to technology; (3) the ICT toolkit; (4) teacher professional learning – CPD; (5) drivers/constraints and the role of the institution.

Participant profiles

As shown in Figure 3, none of the respondents were under 30 years of age or over 70 years old. Almost one-third were either 30-39 years old or 40-49 years old and therefore considered Gen Y or Gen X respectively in terms of generic digital literacy (Wang *et al*., 2009; Morris *et al*., 2005; Tapscott, 1998). One quarter of the group was 50-59 years old and just over one-tenth was in their sixties. Although these latter two categories would not be considered as 'the digital generation', there is considerable evidence of this age group having the disposable income to purchase the latest technologies more so than those in their 30s with family commitments. In addition, working with young people and schools may provide the impetus for acting more like Gen X tutors.

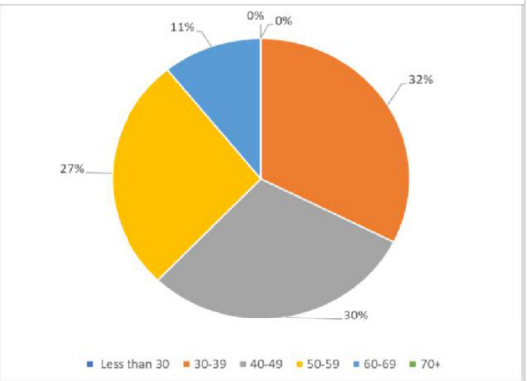

Figure 3: Age profile of Respondents

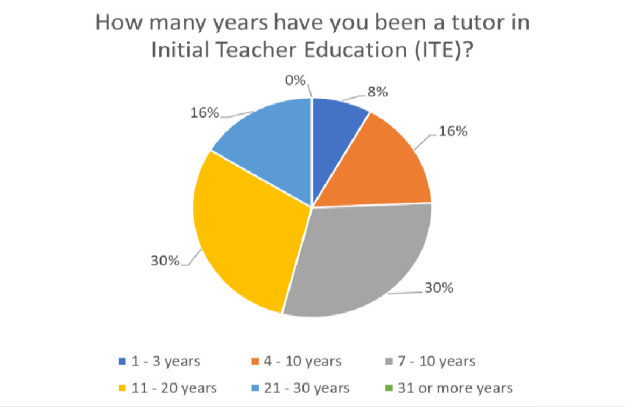

Figure 4: Years in initial teacher education

Many institutions consider the first three years in post as a probationary period during which time additional support for teaching and research (both financially and academically) is provided to early career lecturers, many of whom are making the transition from being a classroom teacher to an ITE tutor. In this sample, as shown in Figure 4, only 8% of the respondents fell into this category of being 'recently in the classroom'. In addition, just less than one-third (30%) of respondents were well established in post, having completed 7-10 years or 11-20 years in teacher education. Finally equal proportions (16%) of respondents were either 4-10 years or 21-30 years in post. Overall the sample of respondents appeared to accurately reflect the diversity of gender, age and experience across the participating institutions despite the low response rate.

In terms of their subject background, almost three-quarters (73%) of respondents did not train student teachers in a STEM subject. Almost half (48.6%) of the respondents indicated they taught mixed subject groupings of students and their teaching differed depending on ICT capability and relevance of the apps or software to the subject specialisms present in their session (Figure 5)

Question	***Response***
Yes, I use different apps/software to match the subject area	60.9%
Yes, I take account of different levels of students' ICT competence	52.2%
Yes, I cover easy to use apps/software with some groups	34.8%
No, all groups need to be familiar with the same apps/software	13.0%
No, all students need to have the same level of ICT competence	17.4%

Figure 5: Impact of student groupings on ITE tutors' taught ICT content

The 'No' options could reflect the policy that NI teachers have to assess pupils' ICT skills and therefore require a broader knowledge base of ICT. Nevertheless the same ITE tutors could also be delivering subject specific ICT sessions as listed in the 'Yes' options.

Teacher Educators' Attitudes to Technology

The second part of the survey considered the ITE tutors' attitudes and skills in ICT. Using an adapted version of the *National Technology Readiness Survey* (Parasuraman and Colby, 2015), tutors' level of optimism regarding the role of ICT in teaching and learning, their own discomfort when utilising technology for teaching and assessment, and their level of innovativeness in relation to embedding new technologies were determined.

As shown in Figure 6, female ITE tutors were more positively disposed ('ready') to using technology than their male counterparts. Indeed, the Gen-X and Gen-Y tutors (aged 30-49 years old) had very similar profiles as shown in Figure 7 with a notably different profile emerging for the 50-59 year olds especially for Innovativeness. As there were only 4 respondents over the age of 60, their profile should be treated with caution.

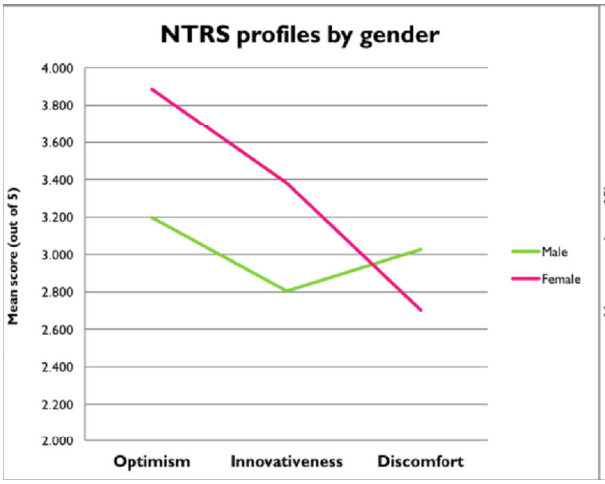

Figure 6: 'Readiness' profile by Gender

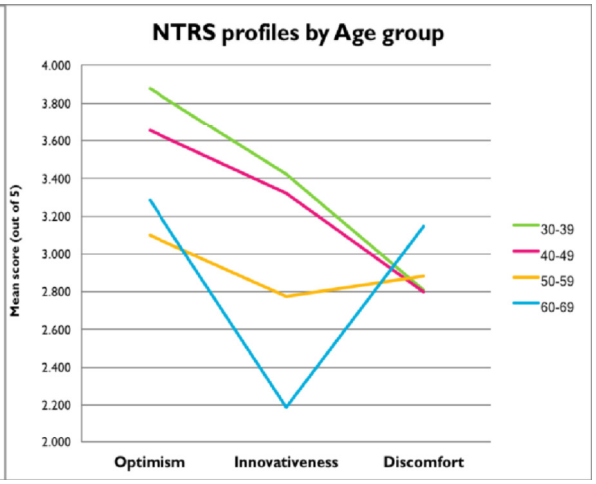

Figure 7: 'Readiness' profile by Age group

It should be noted that Age ≠ Years of experience in ITE as Figure 8 reveals low levels of innovativeness in new ITE tutors (with 1-3 years of experience) plus high levels of discomfort and low levels of optimism for the more experienced ITE tutors (21-30 years experience). Perhaps these results reflect new/probationary lecturers opting for a 'safe' approach using 'tried and tested' methods of teaching using slightly 'safer' technology rather than experimenting with new techniques which could fail and leave them feeling exposed or viewed as incompetent. Conversely, the more mature ITE tutors appear to be over-whelmed by the pace of change and losing optimism in terms of maintaining their role as the 'sage on the stage' (King, 1993). Those respondents who could be considered as mid-career, with 4 – 19 years of experience seem to be adapting most to the changing environment in ITE being confirmed in post and also with many years of commitment and engagement in ITE courses.

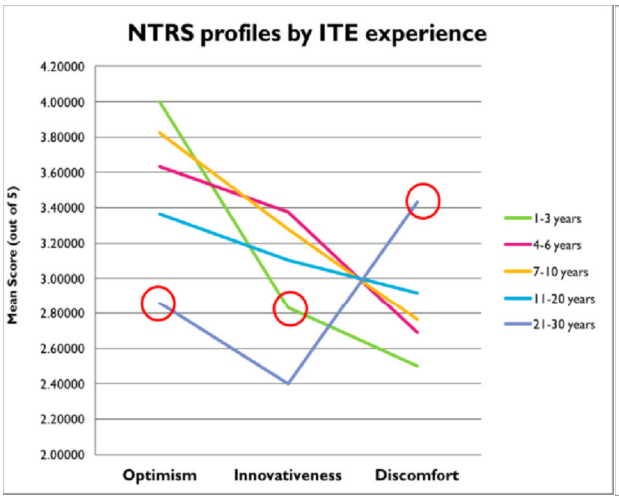

Figure 8: 'Readiness' profile by Years of Experience

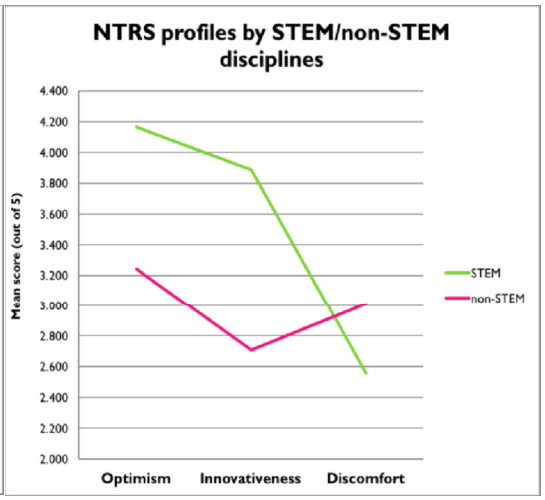

Figure 9: 'Readiness' profile for STEM/non STEM respondents

Finally Figure 9 reveals the stark contrast between the 'readiness' of STEM subject tutors compared to their non-STEM colleagues. For some, this may reflect the use of pre-existing online STEM resources or simulations compared to the more creative, developmental stage of non-STEM materials.

The comments made by the respondents at this stage in the survey fell into four categories: Pedagogical readiness; the Divergence between self and pedagogy; Personal use/Self 'readiness'; and Technical, pedagogical capability, as illustrated below:

> *Technology per se does not necessarily lead to more effective teaching and/or learning. However the effective use of 'Technology' for the enhancement of teaching and learning can be hugely rewarding for students/pupils and teachers/lecturers alike.* (Pedagogy)

> *In answering these questions I acknowledge that my interest in ICT applications runs a long way behind my understanding and application.* (Divergence between Self and Pedagogy)

> *I think that technology can be used to manage learning very well.* (Personal use/Self)

> *At points some of the potential for learning arising from use of technology is overstated and learning can be superficial and not representative of a class-although again it depends on the type and scope of technology used. Technology can fail but so too can many resources and teaching strategies and as long as there is a backup or plan B, IT should be utilised if it is better placed to support learning than other methods.* (Technical, pedagogical capability)

These categories were probed further in Phase 2 of the study when lesson observations and individual interviews were completed with a selection of volunteers.

The ICT Toolkit

Accessibility may account for the lack of technological use in ITE courses rather than fear of the technology itself. In the third section of the survey, respondents were asked to categorise which ICT tools they used in their preparation for ITE teaching and this was compared to the tools they used when actually working with the ITE students in taught sessions. Six options were available and the tutors were to select the one with 'best fit'. The selection was:

- I embrace and use this technology
- I feel obliged to use this technology
- I use this technology sometimes
- I avoid using this technology
- I would like to use this technology but it is unavailable
- Not applicable.

The statements above aimed to distinguish between personal reluctance and lack of institutional provision. Content Creation packages, such as Audacity, iMovie and MovieMaker, were embraced and used more **with** students than **for** students (in terms of learning resources). Notably, in Figure 10 almost one-seventh of respondents felt obliged to use content creation packages to support learning. Over 20% of respondents reported ICT usage as 'not applicable' for both teaching purposes and with students.

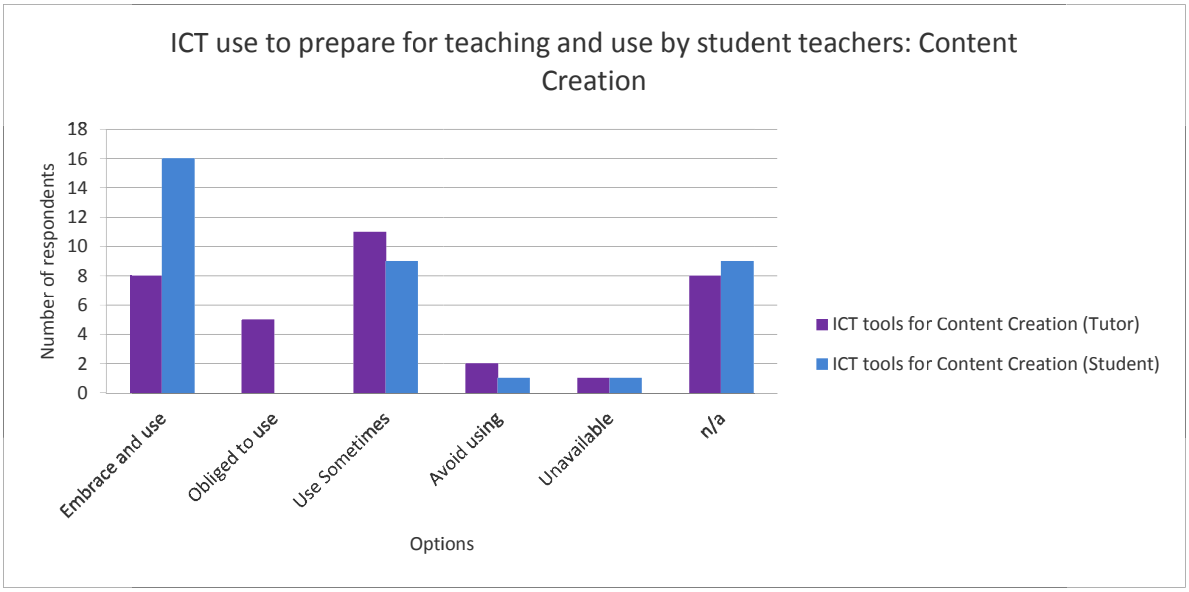

Figure 10: Comparison of Tutor and Student use of Content Creation Tools

When the question was repeated for Collaboration tools (such as Google Hangouts, Skype, Wikis) there was more equitable proportions of tutors and students embracing and using these facilities. Indeed, more respondents indicated they used these tools 'sometimes' especially with students. However, over 10% of respondents admitted to purposely avoiding their use as shown in Figure 11.

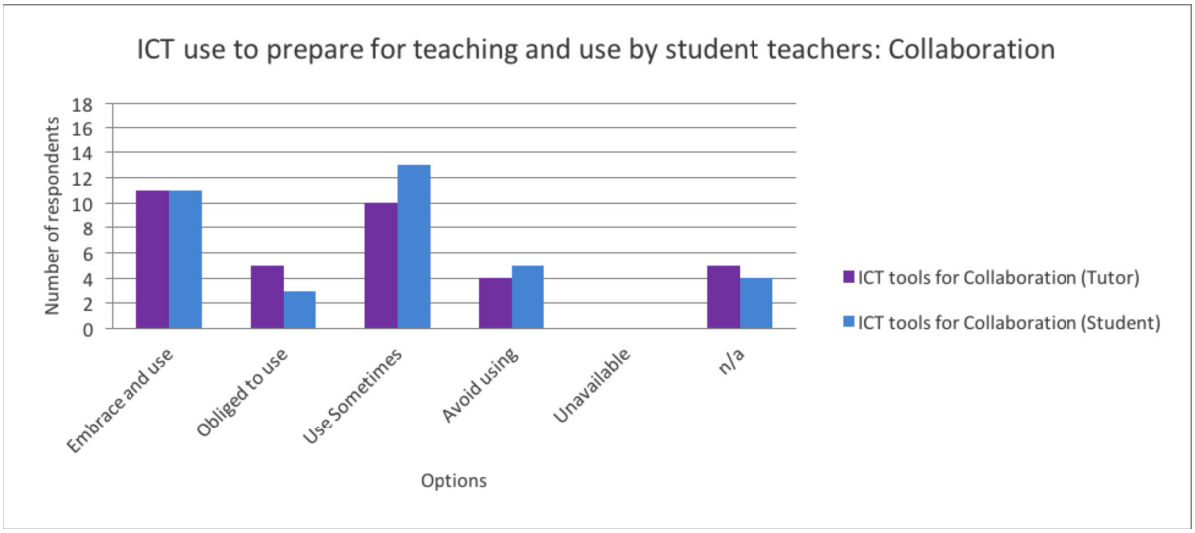

Figure 11: Comparison of Tutor and Student use of Collaboration Tools.

When tools for Assessment were considered, almost half of the respondents agreed they embraced and used Dropbox, Socrative and other online assessment apps frequently or sometimes (Figure 12).

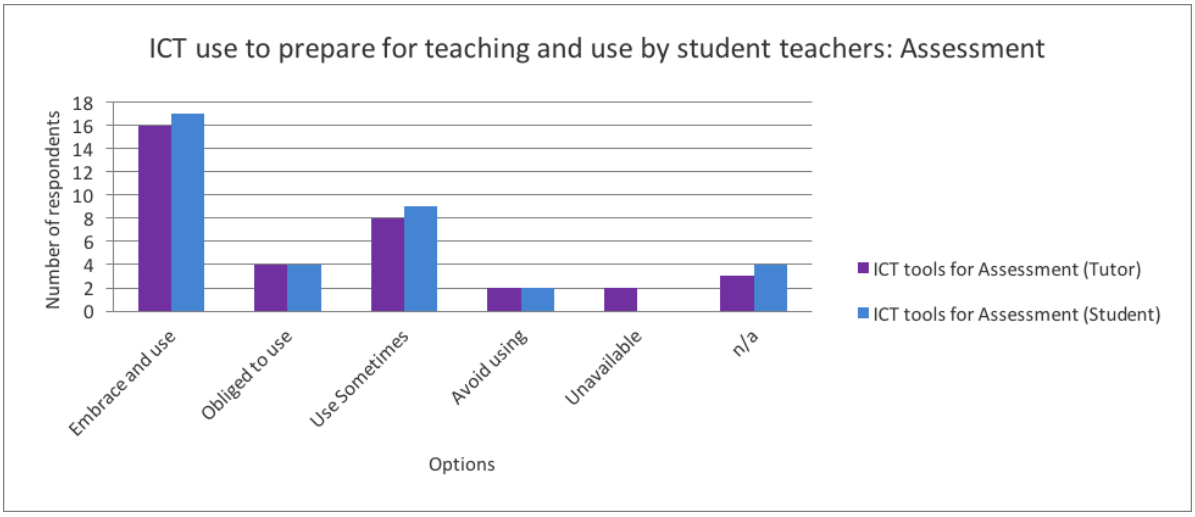

Figure 12: Comparison of Tutor and Student use of Assessment Tools.

As anticipated, three-quarters of the ITE tutors who responded to the use of ICT for Presentation purposes and also reported use of VLEs. Almost half of the group used online simulations, databases and hardware such as IWBs and Apple TV. Subject-specific apps such as MyMaths and GIS were classified as n/a in almost half of the respondents' minds. In terms of the reasons for using technology, respondents were asked to rank order the following statements:

1. I embrace technology because I can see how it facilitates knowledge creation, productivity and an enthusiasm for lifelong learning.
2. I use technology with my students to enhance and deepen student learning (e.g. by connecting work in the classroom to wider societal issues)
3. I use technology to model classroom practice in embedding technology into teaching and learning for my students.

Option 1 was rated the most important reason with the remaining two options having almost the same mean score (2.06 and 2.09 respectively) revealing ITE tutors are committed to the broader goals of lifelong learning.

Using a 5-point Likert scale (1-Strongly disagree to 5-Strongly Agree), the respondents recorded the extent to which they disagreed or agreed with the following statements (Figure 13):

Statement	***Mean score***
I support didactic teaching of ICT skills	2.79
It is more valuable to use video-supported self-study training materials than face-to-face training.	2.52
Technology is best experienced via collaborative learning.	3.55
Independent learning of new technologies is difficult.	3.06

Figure 13: Pedagogical approaches of teacher educators

Although collaborative learning is being recommended by tutors, it is worth noting the high mean score for didactic teaching of ICT skills perhaps resulting from the impression that independent learning is difficult in the case of new technologies.

In terms of promoting ICT in ITE, the 5-point Likert scale revealed the personal benefits to students (through re-drafting or to support those with SEN) were foremost in the ITE tutors' minds. Blended learning was ranked third while the diversity of student teachers ranked fourth indicating an awareness that the learning environment played a key role in assisting student teachers' development. Joint fifth were the 'scaffolding' uses of technology to support face-to-face collaboration within the classroom and to encourage future collaboration across schools. Of least importance to the ITE tutors was the role of ICT in improving student teachers' exam results.

As shown in Figure 14, the ITE tutors' priorities focused on the development of each individual student as a professional and how ICT could be used to achieve this goal.

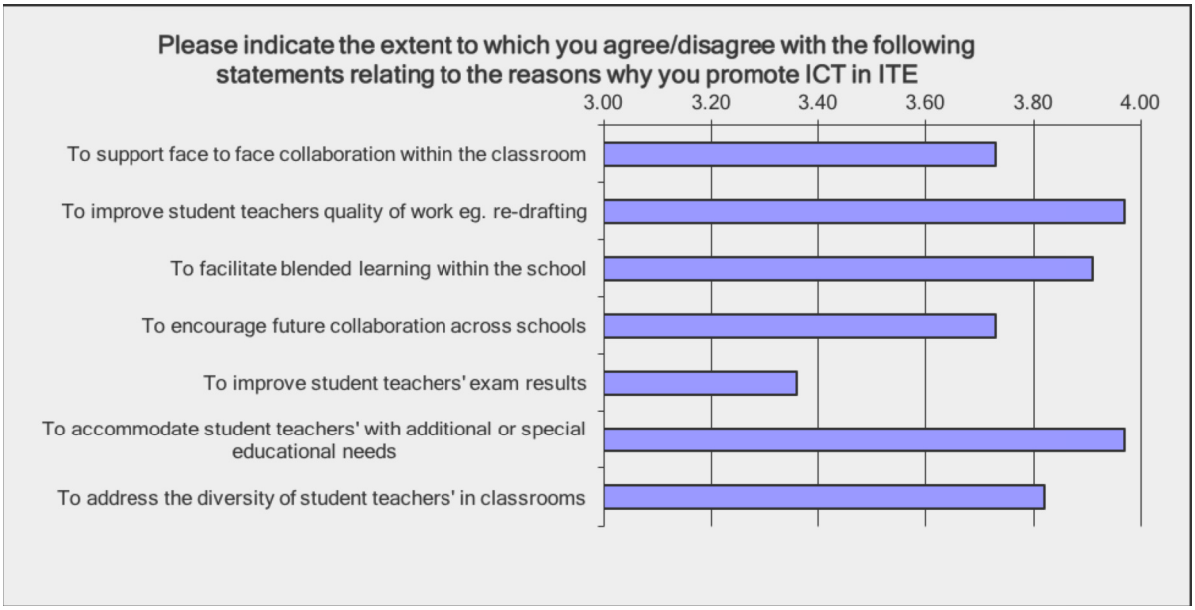

Figure 14: Reasons why ITE tutors promote ICT in ITE

As shown in Figure 15, ITE tutors revealed employment as the main reason for developing their students' ICT skills. This was closely followed by the two statements which focused on key school-based roles such as supporting other members of the teaching community and assessing pupils' ICT capability in their subject. The least important reason was deemed to be their oversight of worldwide issues including cultural and religious differences.

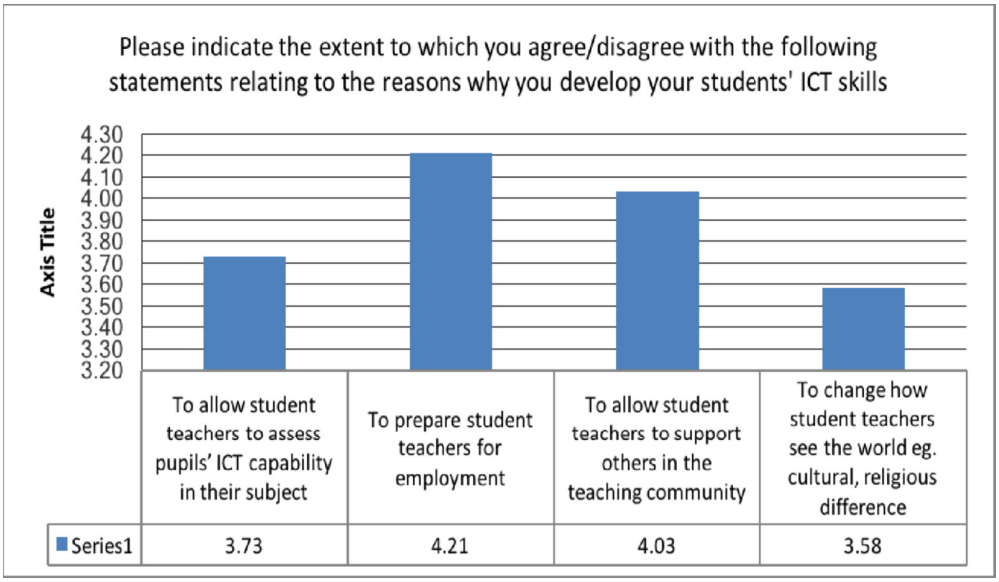

Figure 15: Reasons as to why ITE tutors develop students' ICT skills

Teacher Professional Learning – CPD

To determine the extent to which existing ITE tutors are transitioning from the use of digital technologies as a **functional** tool for teaching *TO* an approach that conceptualises the use of ICT as a key **enhancer** of learning and ultimately to **transform** learning by making connections globally (Rogers, 2000; Hoffman and Preus, 2016), ITE tutors were asked to choose the statement which 'best fits' their perception of their own use of technology. Figure 16 shows almost equal proportions of respondents associated themselves with each of these categories.

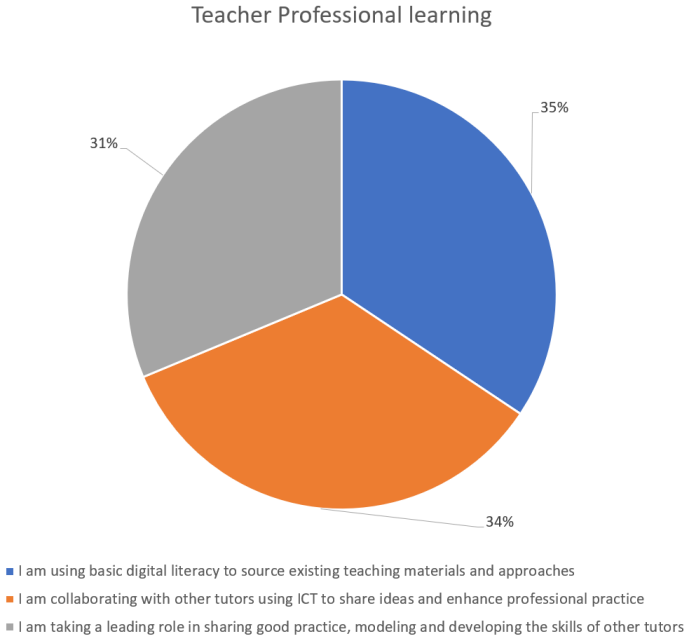

Figure 16: Proportions of teacher educators on each of the key phases on the transformation continuum

As the ITE tutors themselves are making the pedagogical journey from automation to transformation (November, 2000) in their use of technology in teaching, perhaps the OECD (2010, p. 7) concerns that "*those who have the responsibility to teach the New Millenium Learners have to be able to guide them in their educational journey through digital media*" will seek solace in this evidence that the ITE tutors are 'experiencing' the same professional journey as their charges. Indeed, fears by Judge & O'Bannon (2008) that tutors' lack of digital competence meant they could not act as competent mentors during internships, may be reducing. In this study, over two-thirds of ITE tutors are using collaboration and demonstration to share ideas and develop new approaches using digital media.

When asked why tutors develop their students' ICT skills, responses ranged from those falling into the functional role such as meeting the requirements of the teaching profession; to strategic reasons such as becoming part of the community of professionals (personal) or to address cross-curricular learning (pedagogical); the third category touched on the transformative approach advocated by November (2000) with the broader education system being at the heart of the rationale (Figure 17).

Research literature reports the long-standing concern of lack of time for teachers (and ITE tutors) to experiment with new technologies and to develop the resources required to embed ICT into their classroom practice. Due to the increasingly ubiquitous nature of technology, and the intuitiveness of many apps, formal training sessions with large groups of like-minded tutors are no longer required. MOOCs provide opportunities for 'planned' CPD through self-study or external courses, while YouTube

videos offer 'just-in-time' training for ITE tutors who learn through personal trial and error or partnerships with colleagues or friends. As shown in Figure 18, personal experience ranks highest, followed closely by input from friendship groups and collaborations with colleagues. As CPD providers, external courses or workshops are often offered by the institution to teachers rather than attended by ITE tutors.

Reasons	***Mean score***	***% agreement***	***Continuum…***
To prepare student teachers for employment	4.21	91%	Functional: Teacher as a professional
To allow student teachers to support others in the teaching community	4.03	79%	Strategic: Community of professionals
To allow student teachers to assess pupils' ICT capability in their subject	3.73	69%	Strategic: Cross-curricular learning environment
To change how student teachers, see the world e.g. cultural, religious difference	3.58	57%	Transformative: Education system

Figure 17: ITE tutors' reasons for developing their students' ICT skills

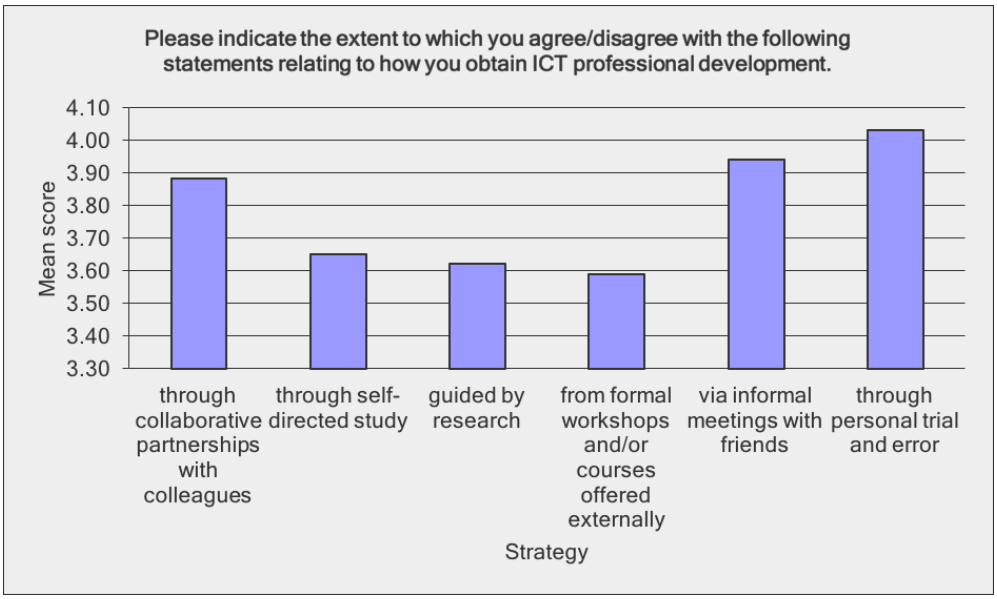

Figure 18: Types of CPD reported by participants.

Drivers/Constraints and the Role of the Institution

When considering the survey findings through the lens of the *UNESCO ICT Competency Framework for Teachers* (UNESCO, 205) a dichotomy emerges. It may be concluded that institutions play a key role in policy development relating to *Understanding ICT in Education* by facilitating the transition from Technology Literacy to Knowledge Creation through their provision of hardware and software to staff (*ICT*) and their requirements to utilise the university's VLE as the main mode of delivery and assessment (*Curriculum and Assessment*). It should be noted however that the level of complexity and

pervasiveness of the ICT tools for teaching is restricted in many institutions as indicated by multiple tutors' choice of 'not applicable' for the subject specific packages/apps and tools for pupil creativity.

On the other hand, ITE tutors assume control of the *Pedagogies* used within the VLE for structuring and supporting the learning process to promote knowledge creation with the tools available. The *Organisation and Administration* of the taught sessions highlights the gulf between the digitally literate tutor who is automating and enhancing his/her pedagogical approaches and the innovators who are embracing technology to promote further knowledge creation alongside their student teachers. There appears to be limited evidence from the survey that collaborative groups of student teachers working independently are prevalent in the current ITE provision. Finally the mentoring and guiding of ITE tutors' development as a professional (*Teacher Professional Learning*) is heavily reliant upon personal commitment and interest often gained through friendships or collegiality in the workplace.

The observation and interview data in the next section offers further illustrations of the Institutional and tutor differences revealed through the survey in relation to the UNESCO framework matrix.

Observations and Interviews with Teacher Educators

As discussed, Phase 2 and Phase 3 of this study saw the research team engage in a series of observations and semi-structured interviews with teacher educators on the island of Ireland.

Observations of taught sessions

Ten taught sessions were observed in institutions both North and South of the border addressing both primary and post-primary teacher education and also a range of subject specialisms including STEM and non-STEM in equal proportions. These tutors were interviewed afterwards about the teaching approaches adopted in their observed session and in their general teaching. Two additional ITE tutor interviews were completed in an Irish Institution where observations were not possible due to timetabling restrictions.

The observed sessions included both subject-specific use of technology and also generic hardware and software training. Some ITE tutors reported an institutional commitment to a single ***Virtual Learning Environment (VLE) platform*** conforming with university requirements for usage while others noted the use of iTunesU or Moodle (used as a repository of resources). Even within the same institution there was a wide variety of approaches adopted due to some institutions not having committed to a single VLE platform. The academic freedom to select a platform, which was 'fit for purpose' to the ITE tutor, allowed for the early adopters and innovators to strive forward and excel, unhindered by institutional restrictions. However, those tutors with less technical kudos appeared restrained by the lack of support mechanisms and scaffold typical of the departmental collegiality reported where an institutional VLE existed. Although change can be motivating for the learner, the lack of a coherent approach across a series of taught sessions within a single institution was notable to the observer and therefore potentially to the students enrolled in the programmes (although they were not a focus of this study).

Traditional teaching still prevailed in some sessions in stark contrast to the majority of observed teaching where the pedagogical use of technology 'enhanced' the learning experience or 'extended' learning by student teachers. In terms of the design of the technology activities being utilised, there were few instances of 'transformation' extending beyond the home institution, with little collaborative activity occurring between the institutions themselves. Nonetheless it should be noted that tutors' use of technology was pedagogically 'disruptive' challenging students and often uncovering deep-set misconceptions. In other cases, students were required to work independently on the creation of unique and original artefacts and showcase these to their peer group. This type of activity demonstrated ITE tutor's confidence and innovativeness to embed ***a constructivist approach*** into their teaching especially where face-to-face teaching time was limited. Other examples revealed opportunities for student teachers to 'drive' the learning process through peer support and collaboration assuming the role of the 'teacher' and demonstrating new skills or apps through TeachMeets or similar pre-planned student-led sessions.

Where new technology or hardware was being utilised, such as iPads or IWB/Touch Screens, there were new ***rules of operation*** in these taught sessions. The ITE tutors from STEM subjects tended to model the teaching of a topic and the student teachers participated as 'willing pupils' engaging in the questioning and completing the Think, Pair, Share tasks using the technology and "*modelling what the kids will do"* to *"grasp the realities of doing this in class and the different scope expected of lessons at Key Stage 3, 4, and 5*". In another Institution, the non-STEM student teachers became the 'sage on the stage' and the ITE tutor was the 'guide on the side' prompting for student teachers' reflections and discussion on the pedagogical value and impact of the apps or IWB activities shown by their peer. The key outcome of both practices was the ***Modelling Technology for Classroom Practice*** in the 'ideal school'. Although both practices had their merits, some tutors however commented that "*the problem still remains whereby we show them [student teachers] all of this wonderful stuff....then when they go out to school [placement] at most they will have a computer and an overhead projector. However, part of teacher training is about adapting*..." The final comment indicates the importance, in some schools, of being aware of how to make the most of even a single handheld device when network connections are unavailable. This point was developed further by the tutors later in the interviews.

In all observed sessions the ITE tutors, or student teachers through the task set, were invoking their personal perspective on ICT in their subject and their willingness to succeed in terms of their disposition or demeanour towards integrating the technology available into their teaching. It was important for them to recognise when technology usage could meaningfully promote learning and when it was being used as a 'gimmick' with no clear educational purpose. Through post-observation discussions, the difference in tutors' technological pedagogical content knowledge was the driver or barrier to embedding technology in the taught sessions with student teachers.

ITE tutors were open in their reflections on themselves, commenting: "*As new apps come on board or I become aware of them then I do try to integrate them into the course*." and often comparing their own practice to that of their colleagues: "*I would say what I have been doing is quite traditional in terms of using the ICT tools and integrating them...he is using more modern tools* [such as voting]." Or "...[Tutor] *is an advocate, has used Twitter for larger classes..."*

Transformative teaching

There was only one instance of true 'transformation' reported in the interviews whereby cross-institutional partnership existed. In that case, large financial and time commitments were made by two institutions to purchase drones and mini-robots for a joint STEM project across the institutions with student teachers supporting the young pupils in learning to control their drone: " … *we had maps of Ireland and Britain and we gave them coordinates for example … and the coordinates were based on cities, and once they had found the cities they had to fly the drones from city to city. So that was a great leveller, and it's a generalisation but the children thought that is was fantastic …to get children from all sectors together … they were only interested in one thing and that was using the drones … it was also the shared experience of the [student teachers] ... because they acted as the mentors for the young pupils … so therefore you had the experience of being involved in a project that interacted with young people … and it was a different experience for all of us, all round … so it was very rewarding*."

It should be noted however that third level institutions tend to work independently with different regulations and quality assurance processes to be addressed and therefore opportunities for collaborative teaching of this nature are limited. In addition, Intellectual Property Rights (IPR) and overall responsibility for students' welfare and assessment needs to be addressed before cross-institutional collaborations can become viable and agreed by senior management.

Network connectivity

Discussions with ITE tutors revealed the impact of infrastructural differences between the connectivity in schools in both jurisdictions. All schools in NI have broadband connectivity of 10MB via regional hubs including wifi, regardless of geographical location. In contrast, Irish schools are reliant on the existing broadband provision in their area. The need to factor in connectivity was noted by the ITE tutors in Irish institutions:
"*Another issue that is complete nonsense is this idea that all schools are net-ready. Nonsense. At primary, the broadband initiative wasn't extended so that's rural schools out of the way. At Post-primary level, yes, all schools have broadband*."

However, the climate of online resource provision by publishers adds additional pressure to an over-stretched infrastructure in Ireland: "*…another issue relates to wi-fi, that it isn't strong enough in the majority of primary and post-primary schools for the type of learning we need. And now, we have a lot of textbook publishers switching to online resources. A lot of these are wi-fi reliant*."

Despite the regional broadband provision, the ITE tutors in NI face new challenges. As ITE providers are classified as External Organisations in a predominantly school-based network called My-School, some ITE tutors struggle to gain ***access*** to C2K and therefore "*made no use of Fronter*" – the VLE embedded in My-School – resulting in the use of iTunesU on iPads and apps such as 'Explain Everything' dominating in their course provision. In contrast, other ITE providers do focus on Fronter as the school-based VLE and offer sessions on online course design to all student teachers. In more recent years, Google Classrooms and OneNote Class have also entered the NI school sector as alternatives to Fronter therefore extending the range of platforms to be considered by ITE providers within an already tight timeframe of 36 weeks, 24 of which are on school-based practice. "*We get our students to do a lot of work in Fronter but really*

they are telling me that schools aren't using Fronter … and it depends on the individual school. Some schools have a real culture of embedding ICT and using Fronter and other schools don't."

Aside from the VLE platforms, *"some schools are just cutting edge doing such exciting things, while others are doing very little … that is a bone of contention*" for student teachers wishing to observe good technology integration in the classroom. Consequently, some ITE tutors "*tell them [student teachers] the stark reality of different levels of provision in schools*" (without naming the schools concerned) prior to commencing their school-based placement.

It is important to note that institutions both North and South believe teacher education courses should aim to develop lifelong learners who have the confidence and competence to continue to adapt to an ever-changing educational climate: "*What we want to do is to obliterate this notion of 'the present school I'm in doesn't have good ICT facilities' and move students towards the concept that they are looking out on a thirty-year career. In other words to develop that capacity for students to continually re-invent what they do and when new technologies come along they are not overwhelmed by this."*

As noted by the ITE tutors, the student teachers "*should be challenged if it [ICT] is to be taken seriously. Of course, there are times when you don't need ICT but they [student teachers] need to be challenged to critically think of how it can be used"* and to be imaginative in their design of pupil activities.

Assessing student teachers' ICT Competence

Lack of network connectivity impacts on the Irish ITE tutors' role when assessing student teachers' use of technology in their classroom practice. For many student teachers, geographical location determined the extent to which they could experiment and utilise technology in their pedagogical approaches as acknowledged by the ITE tutor: "*I mean on a number of occasions I've gone out [to observe a student teacher] and the poor student is trying out something different and the wi-fi drops*."

ITE tutors in Ireland recognised these inequities and the need for alternative strategies to assess student teachers' ICT competence. "*One student could be in an urban school where the wi-fi is excellent and then another student could be in a rural area, weak wi-fi, no broadband. ...As a result you can't mandate them to do a particular lesson*."

One solution was mentioned "*Students aren't mandated specifically. They do write a review of lessons. We don't focus on ICT specifically but naturally if ICT has enhanced their lessons, of course it should be included*."

In NI, the assessment of pupils' competence in Using ICT (UICT) is completed by subject teachers as a cross-curricular theme making all teachers responsible for developing pupils' ICT ability. As a result, "*the ICT portfolio has been a part of the PGCE course for over 10 years*" in some institutions and therefore some tutors expect more than just skills-based competence and require student teachers to create an online Fronter course in the subject area to be taught as blended learning. While other ITE tutors ask student teachers to "*write a Year 10 'Using ICT' task which is quite a difficult thing to do*" based on the CCEA UICT criteria. This practice is not consistent across all institutions in NI but offers an insight into alternative methods of engaging student teachers' with the statutory requirements of the curriculum.

In other institutions there have been *"no formal mechanisms for students to record and evaluate the use of ICT. Around 2 years [ago] students used the ePortfolio to do this … but a staff member left and External Examiners wanted to cut down on written requirements*." In recent years "*the only check on student use of ICT was through formative and summative profiles, in January and May … because it is a 'basic competency'… but not an 'externally imposed requirement'".*

Optimism versus Discomfort

Based on the evidence of optimism presented through the interviews and observed sessions, it appears optimism is a by-product of collaboration and peer-support by more knowledgeable others. In many cases, the examples of optimism were voiced through a third person who was aware of the opportunities for innovative practice, rather than the first-person perspective of the implementer of the practice: *"I said why don't you use Scratch Junior to get characters speaking in Irish and she didn't make the link. So it's that business of making the link … you have to have somebody who is confident enough of using the technology, who knows what they want to teach and who needs that spark of an idea to say … listen, there's the link … and that is in the hands of a good teacher … and that is what I emphasise to the students: it is not just about using the tools, it is all about teaching the children but* ***you*** *have to make the link and that is where the good teachers come out."*

As mentioned earlier, it is the challenge of knowing when to use the technology to achieve the greatest gains that defines effective embedding of technology in pedagogical practices: *"What I try to instil in the students is that ICT is part of the toolbox of teaching and learning … it is not the 'be all and end all' and it shouldn't take over classroom practice … it's useful if it's going to accelerate the learning but if there is a quicker way to do something be it that using flash cards or reading from a textbook then that's the best approach to use … so it's about the student teachers and teaching them to be judicious in their use of ICT … not to get carried away with the activity and make sure they're focusing on the learning…"*

However, it is also the role of the ITE tutor to sustain the motivation and optimism of student teachers even in the face of limited technical resources. *"Yes, certainly we would hear a lot from student teachers that we are teaching them to use the iPad and they are then faced with an overhead projector in a school."* With the right outlook, even an overhead projector can be used in a creative and engaging manner to produce a wall frieze of a historical event or a representation of a geographical feature. As noted above, it is the 'good teachers' who can adapt.

Nevertheless, even the most ICT-literate and optimistic ITE tutors can experience technical problems leading to discomfort: *"Various electronic holes may cause things not to go well. In a generic session earlier in the year I just wished the ground would open up and swallow me whole. I was showcasing the use of Plickers or Socrative and the network went down with AirPlay and nothing would work properly so it appeared as if I didn't know what I was doing when all the time the connection was getting lost. I just had to stress what would happen if the network was playing ball and then eventually the connection was restored and they [student teachers] were able to see it properly."*

The upshot of the experience however was that student teachers realised that sometimes technical glitches occur with even the most well-prepared and experienced teachers yet this doesn't stop them from using the same technology later in the course.

Innovativeness

Building on the optimistic attitude towards experimenting with the technologies available, ITE tutors discussed the pedagogical shift they had experienced when enhancing their lectures through the use of new apps. The realisation that the app allowed them to capture and record the process which was more important to the student teachers than the product, especially in STEM subjects: "*that screen Castamatic that I was using for those videos, things like that … it has taken me a while to realise that as well … it's not the written solution on the board that matters … it is arriving at that solution through the process … and you need to capture that process for that type of work … it works for that …*"

Even the more traditional teacher-led sessions on the IWB can become a learning resource in themselves when recorded and saved, then shared with the student teachers via the VLE. "*the interactive whiteboard completely changed the way I teach in that I used to write stuff on the board and they wrote it down and I rubbed it out … what I can do now is I can capture every class but even over that I have captured the screens from every class on the interactive whiteboard … I save them as a PDF file and we put them up on Fronter*"

In addition to the processes noted above, which use the tools to innovate, ITE tutors often pose challenges to themselves to uncover new or emerging teaching resources to share pedagogically sound uses of these apps or websites with student teachers: "*Yes as new apps come on board or I become aware of them then I do try to integrate them into the [subject] course. For example, [package] that I used today is a new bank of resources that has come on board via CCEA. I think it would have been remiss of me to have turned a blind eye and do what I have always done and teach [topic] the way I taught last year's cohort when there are other ways to look at the topic now*."

Automate versus Informate

For many tutors, being innovative appears to exclude the lower level automation of processes eg. using online quizzes or voting tools which track the participants' scores, as some tutors say: "*it might be fun to use Plickers, it might be fun to use ClassDojo but, if that's not going to move the children along in their learning, then there is no point in actually using it … it then becomes a futile exercise where the focus is on the activity*."

However, from the STEM teacher's perspective, the information recorded from the automated marking of an online quiz can uncover misconceptions in pupils' understanding of a concept or process if analysed thoroughly. As one STEM ITE tutor declared, the "*Plicker activity alone may not directly impact on pupils' learning*", however we shouldn't underestimate the value of the data recorded in informing future teaching. For that reason, the ITE tutors demonstrate to student teachers how to access and 'read' the tracking reports to maximise the benefit of automated assessment. The choice of app or online assessment tool is also important as the ITE tutor needs to ensure they are applicable for school-based use via AirPlay or embedded in Moodle or other school-based VLE.

"*A lot of people would use technology to break away from traditional style lectures. For example, Mentimeter, Kahoot!, all that type of stuff. Another choice of application would be one that is easy to use … and also free so cost is not an issue*."

"He has got the quizzes online … he uses a thing called Shakespeak which is one of these voting response things and they [student teachers] have to vote on that… I would say what I have been doing is quite traditional in terms of using the ICT tools and integrating them … he is using more modern tools …" to record results via the built-in tracking tool. As before the final step of interpreting and using the results

to guide future teaching has been omitted from this tutor's comment on his colleague's more innovative practice.

As one ITE tutor commented:
"The challenge in terms of trying to get staff to use ICT is that they have been doing things traditionally so many years in the same way that they don't see that this adds anything to what they are doing … and they don't see how it does it any better … and if they have the technology … they don't have the confidence in using the technology, and I think what it needs is they need some space and time to play with the technologies first .. and they need to make the link that … hey, this piece of technology does something that will actually do that better than what I am doing at the minute … so if they see it as an add-on that either has been forced on them or that has been advised for them to do for the sake of them doing it … it's not going to work … they have to make the link themselves" Once this link has been made, better decisions on the role of the technology to support teaching and learning can be made as discussed below.

Enhancement as a stepping stone
For many ITE tutors, enhancing their existing practice is the stepping stone towards 'disrupting' the learning process and ultimately 'transforming' their pedagogical practice.

"*The way I approach IT with my students is that I infuse it throughout teaching and learning of the [curriculum subject] PGCE and by that I mean it is not the 'jolly' or the 'bolt-on' but is an integral part of what I as a teacher educator do"* and *"Using ICT is most effective when it is embedded into topics and enriches the pupils' learning in some way rather than using ICT as a gimmick where some hands-on active learning activity would have been more appropriate. I encourage students to think - is ICT the most appropriate vehicle?"*

Types of embedding include modelling, accelerating and extending the tasks to real-life contexts, through ITE tutors drawing on their own experiences as classroom teachers: "*It is **modelling** good practice that they can use in the classroom more than anything and the focus very definitely on this course will be on teaching and learning at **school level** and for that reason we do use apps that I as a teacher would have used in the classroom as teaching*" and "*[apps] that I know are specific to [curriculum subject] classroom and are conducive to **accelerating** I suppose [curriculum subject] learning*
or
*"It was introducing a more **dynamic** element to the activity and **modelling** how the students could use the facility … to* change the graphs very efficiently rather *than going back each time and re-drawing the graphs which could have been rather cumbersome and time-consuming even in [app]. I feel that was a valuable pedagogical lesson for them as in a later topic … so I feel that was useful as it will arise in other contexts."*

There remains the ultimate goal of enhancing student teachers' employability: *"I feel that students need to have a range of resources to draw upon so as far as possible I try to model in session and or at least discuss how to use ICT in topics. **Job descriptions** often clearly state the ability to use ICT effectively in teaching …which is then tested by the question at interview. So it does help [student teachers] get jobs if they can go in and talk about sensible applications of technology in the teaching of the subject."*

As the ITE tutors noted: "*Baseline is that ICT should only be used where it enhances learning…'transformative is a strong word … the internet itself has transformed learning…some of the*

approaches enabled are transformative…" while others disrupt the learning process prior to reaching its transformative use.

The next section addresses the role of disruption in promoting ITE tutors to re-consider their goals and pedagogical approaches.

*"*Disruption" to the learning process

"*Three years ago now, I think it was, I stopped lecturing to my class, because I realised that lectures are a 'thing of the past'. There is no point in someone driving from Tyrone to hear me talk for an hour … so my lectures are videoed in various formats, go up online, and the students have a schedule by which they have to watch those videos … and the idea is that the time spent together is much more active … I teach [subject] so when they come into class, the understanding is that they have seen the lecture and read the text and they are going to set about working together in groups and they do different exercises with the text*". This is a clear example of full disruption to the standard practices of both the ITE tutor and the student teacher. Notably, the online access to the lecture in advance meant the lecture was not repeated in the face-to-face context, but the time was used more productively to apply the new knowledge into a novel context.

Another tutor reported being in the 'transition' stage towards a Flipped Classroom as a means to create the opportunity to demonstrate how to embed active learning into classroom practices, stating: "*We are slowly moving to a flipped approach where they [student teachers] do the reading in advance … or we might give them a video or paper in advance of the session and it then becomes a facilitated approach as opposed to … a traditional chalk and talk lecture. I mean, we constantly talk to our students about engagement, feedback etc. and what do we do …"*

More independent tasks were set for student teachers such as Digital Storytelling through MS PhotoStory for primary pupils. Student teachers role-play the pupils in creating their own story – either through photos taken on their mobile phone or internet images. As the package is intuitive to use, rather than a tutor-led session on how to 'work' the package, exemplars from previous years' students are shown to set the standard. Knowledge construction through 'learn by doing' occurs and the disruptive nature of the challenge encourages the students to be creative, imaginative and original. *"The students do it very well and seem to enjoy it. They may be daunted at the start but they do it really well."* Consequently *"I look back at my previous years of lecturing and think 'what a colossal waste of time'".* However, disruption doesn't live alone. Part of the disruptive process is to change the 'rules' and to re-educate both ITE tutors and student teachers on the art of collaboration and co-operation.

New rules of operation

The constant upgrading of software, introduction of new 'educational resources' like Raspberry Pi, MinecraftEdu, Sphero and other robotics, and also the emergence of new apps on a daily basis, leaves many ITE tutors feeling overwhelmed by the vast challenge of remaining in control of the ever-changing landscape of technology. ITE tutors admitted "*the massive proliferation of apps... left them wondering how to keep on top*". By accepting that "*students will teach the others apps, like quiz apps*" through demonstration and collaboration, ITE tutors can focus on unpicking the educational potential of many of these packages or apps for the student teacher. This goal may be achieved through the student teachers becoming actively engaged in a pupil activity: "*If [student teachers] are having the pupils doing hands-on activities then I would always tell them to have worked through the activities themselves and*

thought what are the pitfalls that may be faced by the pupils? And to have ensured all the necessary steps are in place rather than pupils having to fill in between the gaps and getting it wrong."

As noted by many ITE tutors, student teachers often resort to adopting the same pedagogical practices they experienced as a pupil in school or as a UG student at university. Yet ITE tutors agree *"that all of our students do undergo a transition in coming into teacher education because what they're using at undergraduate level doesn't reflect what we are using in schools and classrooms and that is well documented as you know … this disparity between second level and third level education and all too often our students do come in from the lecture hall set up and, whenever they see the potential for ICT in the classroom, they do learn a lot about it."*

One of the most popular apps on the iPad is 'Explain Everything', due to its fluidity and applicability to offer a range of valuable teaching approaches: "*Students would consider 'Explain Everything' as a teaching technique relative to other more conventional techniques…comparing pedagogy…*"

Leadership/Institutional issues

Financial constraints appear to be the major institutional challenge noted by the ITE tutors who want to implement wider scale staff training and development: "*I basically think that everything is done on a shoestring … it's quite tiring … part of the problem there is, unless you convince the majority of your colleagues to come on board, it is not worth it to pay the money [for equipment and licenses*]"

While another institutional member reported disquiet on the lack of support for new hardware: "*So I am a bit sceptical on how committed the school is to ICT, it may be an issue linked to [my subject] and not other subjects*."

In contrast, the institutional perspective appears unwilling to commit to 'disruptive and innovative pedagogies' notwithstanding a transformative methodology: "*this does not necessarily suit everybody because, in an institution like this, we have people teaching 100 students in a lecture theatre … you have other people working with a group of 20 people in a room which has computers, and people working with a group in a room with no computers…* "

Professional development

In response to the question of who trains the trainers, one ITE tutor commented that *"I'm supposed to go to the States this year … probably in the Autumn. I am supposed to go to a couple of universities on the East Coast who are leaders in this area … just to see what they are doing, and I hope I come back just bursting with ideas of how I can take this forward."*

However, ideas alone will not change a lifetime of drill and practice teaching so what is the driver for change if it is not the tutor themselves? *"if you are going to shift your learning and teaching into a digital classroom, you are not going to do that without re-thinking all aspects of your teaching but it took this [external] guy, to give me an interest in doing that."*

The above example illustrates the role of the External Examiner as a co-collaborator or co-teacher when it comes to ITE tutors' professional development needs. By discussing their teaching loads, the tutor heard about the External's transition to online delivery via a flipped classroom.

Summary points

In summary, "*as a group of teacher educators we need to think about our digital literacy and how we move forward with it*" especially in light of the limited opportunities for professional development for ITE tutors. Who trains the trainers? From the findings reported, it appears personal diligence, motivation and the collegiality of colleagues and friends as a support network, play a key role in ITE tutors' ability to maintain expertise in the face of challenging times in ITE.

Despite the good practice of ITE tutors and their willingness to increase student teachers' employability, for some ITE tutors the institutional practices within Schools are viewed as detrimental to CPD for lecturers especially where investment in new equipment has been requested: "*I would like to say that I am very, very positive about use of ICT in Teacher education and [subject] education and generally for pupils in schools. Just to reiterate again that I feel ICT is not taken that seriously by the Senior Management Team*."

On a positive note, ITE tutors' ability to form a community of learners supporting each other and sharing ideas is a valuable asset to third level education: "*We have a good support network here in terms of technology. What we really need now are specialist supports in the area. … We all know, or I hope we know, about effective feedback and the tools that are out there but I think we need specific supports on core specific tools more than just generic basics*."

By sharing practices across the two jurisdictions, it may be that the subject-specific support can be gained from the collective ITE sector.

Discussion and Conclusions

The attitude of ITE tutors to technology varied considerably and seemed to be impacted by gender, with females more likely to be higher in Optimism and Innovativeness, and lower in Discomfort than males. Optimism and Innovativeness largely seemed to decline with age, but changes to Discomfort were less clear. Taking account of length of service, this seemed to suggest that newly appointed tutors believed that they had lower levels of Innovativeness than more established staff. Those in post for 21 years or more had distinctively low levels of Optimism and Innovativeness, and high levels of Discomfort. Perhaps unsurprisingly, those tutors working in STEM subjects have higher scores for Optimism and Innovativeness in using ICT and lower scores for Discomfort compared to non-STEM colleagues. It would appear that ICTs are not only more used in STEM subjects for Teacher Education, but that those tutors are more comfortable in their use. In the interviews following observations, it appeared that Optimism in ITE tutors occurred as a consequence of collaboration and peer-support. This finding would seem to be at variance with the findings from the survey, as illustrated in Figure 7. It might be expected that newly appointed tutors would not yet have formed the network of professional contacts to allow collaboration and peer-support to happen effectively, while more experienced colleagues would have this network of support. Perhaps some of their perception of a lack of Innovativeness in newly appointed tutors compared to more established staff is related less to knowing who to approach to provide support and to work alongside to drive good practice forward, and more to a willingness to collaborate and support each other in the more recently appointed tutor role.

From the interviews there was a clear recognition of the importance of the ITE tutor in fostering Optimism in student teachers, and an understanding of the need to develop a positive attitude to ICT use, and developing the resilience and adaptability for the student teachers in the classroom not to be deterred, should there be technical difficulties in some ICT experience. There was a feeling that the benefits should be demonstrated and they outweigh any possible challenges that might be encountered in using ICT.

ICT for Content Creation

Much of what the ITE tutors use ICT for is in Content Creation. However, when examining ICT use in preparation for teaching, there was a considerable disparity between tutors embracing and using ICT for Content Creation for their own teaching and the use of ICT for Content Creation for their students. Many tutors are not creating content to support their own teaching; instead they appear to be using Content Creation tools with their students, modelling their use in the classroom. Enochsson & Rizza (2009) stressed the importance of mentors acting as role models for student teachers, and this might suggest that there is some evidence of that occurring now.

However, the suggestion in the results that the use of Content Creation tools is institutionally driven is somewhat disappointing. Rather than ITE tutors embracing the technology and its transformative potential for learning with student teachers, and ultimately in schools, this would suggest some form of pressure from Institutions to use particular technologies, which may have a detrimental effect on tutors embracing the potential of innovative technologies. In the interviews, some ITE tutors noted an institutional commitment to a particular VLE with tutors required to conform to using that platform. This was felt to be a restriction on the tutor's freedom to select a technology most appropriate to the needs of the individual student teachers, and the requirements in the schools in which they were likely to be teaching, and may reflect a divergence between the tutor's philosophy and that of their institution (Eifler *et al*., 2001). Such freedom, where allowed, was thought by the interview respondents to encourage early adopters to excel. On the other hand it was noted that that there was a danger of a lack of coherence if different tutors were using different VLE solutions. However, in the survey this difficulty was underplayed, and the reported requirement by institutions was dwarfed by the responses which indicated 'some use' or 'embracing and using' the technologies.

Overall, the survey responses seemed to suggest that at least some ITE tutors were moving beyond seeing ICT as merely functionalist in their preparation of student teachers, towards a more transformative orientation. However, in the observations and subsequent interviews, very few examples of 'transformative' practice emerged, and traditional teaching, albeit with embedded technology, prevailed in most instances. While transformative use of technologies was very much the exception, there was much good practice. Tutors were very quick to evaluate technologies and to reject those they saw as 'gimmicks'; they used and modelled for students technologies which they could see would have an impact on learning and teaching. It is nonetheless the case that, in most instances, this use fell short of 'transformative', perhaps delivering 'knowledge deepening' rather than 'knowledge creation' (UNESCO, 2005). There were some instances in the observations, backed up by interviews, where technology was being used to 'disrupt' and challenge the students' views of learning and teaching, and these were often useful in developing students' conceptions of how best to use ICT to support learning and teaching. When approaching 'transformation', as defined in the literature review, it was noted that both pedagogical alongside technological skills and knowledge of content were important to allow that to happen and so perhaps achieving this alignment to allow 'transformational' use of technology to happen is a challenge facing ITE tutors.

ICT for Collaboration

In terms of using ICT in Collaboration tools, a number of similar patterns were displayed. One disappointing result was the higher proportion of tutors who avoided using ICT for collaboration. Perhaps that suggests an aversion to the online experience, with a preference for face-to-face contact by some tutors. Alternatively, it could imply a lack of awareness of the technologies available to support collaboration, and their potential for enhancing learning. The challenge for education is that, as technological advancement brings new opportunities that could be incorporated in innovative pedagogies, this requires constant updating of hardware and software, and concomitant development of awareness and skills in the ITE workforce, whether centrally provided or through the provision of more flexible opportunities to develop skills. Challenging for any organisation at any time, in public services under austerity financial constraints, under a 'constantly expanding neoliberal model of governance' (Murtagh & Shirlow, 2012, p.46), the challenges may be even greater.

Lack of access to ICT

Few responses suggest that lack of access is a problem for adoption of ICTs in this study, despite findings from a range of studies (Enochsson & Rizza, 2009; Eifler *et al.,* 2001) suggesting that it is a recurring hindrance in ITE tutors' ICT use (p.13f). ICT tools for collaboration, content creation and assessment were available to almost all respondents in this study, and this appeared not to be a significant restricting factor in their use. However, in the interviews following observations, discussions often led to a consideration of variation in school readiness for ICT. Some tutors expressed frustration that student teachers were being prepared to use ICT in their teaching and were positive about the possibilities of its use, only to be thwarted by the lack of ICT availability or the lack of integration of ICT into school provision. Poor broadband in some Irish schools was particularly highlighted and its impact on an increasing reliance on wi-fi was noted. This may reflect variations in ICT policy application on each of the two jurisdictions, similar to those found by Austin & Hunter (2013) elsewhere.

There was an optimism present also and a recognition that ICT was here to stay in schools accompanied by an expectation that ICT hardware, software and connectivity provision would eventually come. Student teachers will be in post throughout their careers in jobs where ICT will become ever more important – it is key that their disposition to ICT is developed, whatever the present disparities in provision to schools.

One suggestion was that new 'rules of operation' were required. With a proliferation of Apps and other software and hardware, it was felt by some respondents in interviews that students should be tasked with mastering these themselves, in collaboration with each other. ITE tutors would then be able to concentrate on pedagogic deployment of the ICT, rather than in the technical details of the ICT itself.

In terms of how ICT was taught, there was some indication in the survey that the technology was being used to develop lifelong learning, rather than primarily to enhance student understanding or to model classroom practice. This was reflected in the observations and interviews and some tutors were explicit about ICT skills and dispositions being career-long objectives.

Models of CPD

Although evidence existed for the avoidance of collaborative tools by some ITE tutors, the statement 'technology is best experienced via collaborative learning' was agreed with quite strongly by respondents, more so than any of the other statements regarding how best to develop ICT skills. While

tutors recognise the value of collaboration in developing technological skills, they appear to eschew online collaboration as a useful mechanism to support learning. It may be that they are interpreting collaboration here as analogous to 'mutual support'. The lowest support was given to the statement regarding video-supported self-study training materials as a mechanism for developing ICT skills, and a relatively high proportion agreed that learning new technologies independently is difficult. This may be a realistic evaluation for tutors who are coping with demanding ITE courses in terms of skill development more widely, within a context of ever-evolving ICT Apps, software and hardware. Each development requires awareness by the tutor through research and professional contacts, and then requires evaluation of the new technology after which, if promising, the technology must be mastered and incorporated into the ITE course delivery.

Tutors' priorities

In the course of the study tutors were asked about their reasons for promoting ICT in Initial Teacher Education. The lowest scoring statement related to the student teachers' examination result, but the most important reasons related to the quality of work, allowing redrafting of assignments for example and accommodating those student teachers who had additional or special education needs. Close behind followed the facilitation of blended learning within the school and addressing student teachers' diversity in the classroom.

It is tempting to suggest that these may indicate an embracing of ICT and its transformative potential within education (Haydn, 2014). It does suggest that tutors perceive ICT development as an important component of an ITE course; they identify it as an important variable in the development of student teachers' pedagogical capability (CEO Forum, 2000). However, a more pragmatic driver emerges when the underlying reasons for tutors developing ICT skills in their student teachers are examined, as evidenced in the survey. The main reason given in the survey is 'preparation for employment', and some tutors confirmed that in their interviews also with some explicit mention of the increasing requirement for ICT skills being included in teacher job descriptions. This may be a wholly realistic recognition that ICT skills are a requirement for a teacher in the 21st century classroom and are a *sine qua non* for working in a classroom.

The relatively low score in the survey given to the statement regarding 'ICT changing how student teachers might see the world', transforming their experiences, might again be a reasonable interpretation of the impact of ICT on the average student teacher. It might also be an indication that the 'transformative' potential of ICT is yet to be fully embraced by all ITE tutors.

In terms of the main research questions, a range of models of practice in ITE provision have been examined. These range from quite basic use of technologies in the tutors' own practice, to sophisticated and innovative uses in tutors' practice and in collaboration with student teachers, where uses of the technology are modelled by the tutor, alongside the student teacher, potentially transforming classroom practice in the future. There was evidence of considerable uptake of the technology, and a willingness to embed it in Teacher Education, alongside a recognition of the importance of doing so. Access to the technology in the Initial Teacher Education institutions, and the development of skills in its use, were not the major limitations that had been found in other studies, although some mention was made in interviews regarding limitations to ICT budgets, lack of support for hardware and structural and timetable issues. However, it should be noted that this was aired by few respondents overall. The generally positive view may reflect an increased ubiquity of access to online software within Initial Teacher Education institutions or more intuitive software design. Alternatively, it

may reflect historical funding decisions. More plausibly, other opportunities to enhance personal skills are now available, which has allowed ICT skill acquisition to be developed without experts on campus but instead through self-study, online help and peer collaboration. Formal workshops, which may have been the dominant format for ICT skill development in the past, are seen by these respondents as the least used type of CPD. It is notable, however, that continuous technological innovation requires a continued determination to ensure that ITE institutions have the commitment to access innovative solutions with the potential of transforming learning.

While ITE provision of ICTs seems not to be hindering the development of student teachers' skills, the lack of provision across the school estate was highlighted in interviews. This was felt to limit the potential development of skills by students when on school placement, and made more challenging the training provided, as the schools in which the students would be placed could vary greatly in their provision of and disposition towards ICT use in the classroom.

There continue to be challenges faced by ITE tutors in their own professional development in new and emerging technologies. There is a recognition that keeping pace with the technology, and the skills required to use it to its full potential, is challenging, although it is reassuring that almost one third of the ITE respondents in the survey felt that they were taking 'a leading role in sharing good practice modelling and developing the skills of other tutors'. Also promising is the evidence from observations and subsequent interviews that many ITE tutors are working together in communities of learning providing mutual support and potentially enhancing practice.

Limitations of the study

Being a smaller jurisdiction, all ITE providers in NI were invited to participate in the study and accepted. However, a purposive sample of institutions in Ireland was required to achieve a 'match' in tutor numbers and institutional composition: primary and secondary, plus undergraduate/postgraduate pathways. It should be acknowledged that an alternative sample of ITE providers in the South may have revealed a different picture of ICT provision within Institutions and placement schools.

Although it is possible to determine the number of staff in an institution, it is more difficult to identify the ITE tutors who predominantly teach on pre-service programmes. As a result, we were unable to establish the response rate for the survey as all staff received the invitation but self-selected according to the criterion of playing a 'core' teaching role in ITE programmes.

Some tutors may have preferred the option of a paper-based survey or they may have left the survey incomplete and therefore it was eliminated from the dataset prior to analysis.

Next steps

This study captured the ITE tutors' perspective on the use of technology in ITE programmes across the island of Ireland. It would be valuable to obtain the student teachers' perspectives on what technologies they wish to use in taught university sessions and what areas concern them most when embedding technology into their school-based practice. Based on the variation of experiences within

and across school sectors both North and South, it would be enlightening to gain an insight into the extent to which student teachers feel pedagogically prepared for facing the challenges of using the school's preferred technology platform in their lessons. Building on this, the views of School Principals and Professional Mentors on student teachers' capability to embed technology into their lessons, would be a valuable insight into the expectations of schools on the student teachers being hosted in their department. In addition, a mutual appreciation of the roles and responsibilities of schools, student teachers and ITE tutors in achieving the goal of creative and imaginative teaching through the seamless integration of technology in the lesson, may bolster the partnerships between the key players within the profession.

Finally the reasons behind the lack of inter-institutional collaboration between the ITE providers to offer a transformative learning experience for student teachers (and schools alike) requires further investigation at both institutional and tutor levels.

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Appendix A

Question Item	*Response Alternatives*
(1) Are you male or female?	Male Female
(2) Which age group best describes you?	Less than 30 30-39 40-49 50-59 60-69 70+
(3) Do you mainly train student teachers in a STEM subject?	Yes No
(4) Do you teach all student teachers from all subjects in one setting?	Yes No
(5) If you answered no to question 4, does your teaching practice differ depending on the subject grouping (select all that apply)?	Yes, I use different apps/software to match the subject area Yes, I take account of different levels of students' ICT competence Yes, I cover easy to use apps/software with some groups No, all groups need to be familiar with the same apps/software No, all students need to have the same level of ICT competence
(6) How many years have you been a tutor in Initial Teacher Education (ITE)?	1 - 3 years 4 - 6 years 7 - 10 years 11 - 20 years 21 - 30 years 31 or more years

Questionnaire Items: Profile of ITE tutors

Question item	*Response Alternatives*
Technology gives people more control when teaching	Strongly Disagree Disagree Neutral Agree Strongly Agree
I prefer to use the most advanced technology available when teaching	
Technology makes me more efficient as an ITE tutor	
I find the pedagogies associated with new technologies to be mentally stimulating	
Learning about technology for teaching my students can be as rewarding as having the technology itself	
The pedagogical benefits of new technologies for my teaching are often grossly overstated	
It seems my friends are learning more about the pedagogical uses of the newest technologies than I am	

I can usually figure out the pedagogical uses of new high-tech products and services without help from others	
I keep up with the latest technological developments in teaching	
I find I have fewer pedagogical problems than other ITE tutors when using technology	
I have avoided trying new high-tech things for teaching because of the time it takes to learn them	
I am always open to learning about the pedagogical uses of new and different technologies	
There is no sense trying out new high-tech products for teaching when the technology I have already is working fine	
Technological innovations can diminish social skills	
Using a new technology for teaching can be risky	
It is embarrassing when you have trouble during your teaching with a high-tech gadget while students are watching	
Technology always seems to fail at the worst possible time during teaching	
New technology is often too complicated to be pedagogically useful	
I get overwhelmed with how much I need to know to use the latest technology effectively for teaching	
With new technology, you too often risk paying a lot of money for something that is not worth much from a pedagogical standpoint	
It is helpful to have the pedagogical use of a new high-tech product or service explained by a knowledgeable person	
I find it pedagogically limiting to use high-tech products that are inherently simple	
I do not feel I am in control of new technologies in my teaching.	
When I have a problem with technology during a teaching session, I prefer to solve the problem on my own rather than ask for help	
The hassles of getting new technology to work in teaching usually makes it not worthwhile	

Questionnaire Items: Benefits and challenges for ITE tutors when using ICT in teacher education

Question item	*Response Alternatives*
ICT tools for Content Creation (e.g. Audacity, Movie-maker, iMovie)	I embrace and use this technology I feel obliged to use this technology I use this technology sometimes I avoid using this technology I would like to use this technology, but it is unavailable Not applicable
ICT tools for Collaboration (e.g. Google Hangouts, Skype, Wiki)	
ICT tools for Assessment (e.g. Dropbox, Google Drive for homework, Socrative, other Assessment Apps)	
ICT tools for Presentation (e.g. Microsoft PowerPoint, Prezi, Apple Keynote, Google Slides, interactive multimedia, Explain Everything)	
ICT tools for Pupil Creativity (e.g. iMovie, games, mind mapping)	
Subject-specific packages / apps (e.g. MyMaths, GIS)	
Existing databases or online simulations	
Virtual Learning environments - VLE (e.g. QOL, Moodle, iTunesU, EdModo)	
Hardware (e.g. Interactive Whiteboard, Apple TV, Google Chromecast)	

Questionnaire Items: Use of technology in teaching – Preparation for ITE teaching

Question item	*Response Alternatives*
ICT tools for Content Creation (e.g. Audacity, Movie-maker, iMovie)	When working with ITE students I embrace and use this technology When working with ITE students I feel obliged to use this technology When working with ITE students I use this technology sometimes When working with ITE students I avoid using this technology When working with ITE students I would like to use this technology, but it is unavailable Not applicable
ICT tools for Collaboration (e.g. Google Hangouts, Skype, Wiki)	
ICT tools for Assessment (e.g. Dropbox, Google Drive for homework, Socrative, other Assessment Apps)	
ICT tools for Presentation (e.g. Microsoft PowerPoint, Prezi, Apple Keynote, Google Slides, interactive multimedia, Explain Everything)	
ICT tools for Pupil Creativity (e.g. iMovie, games, mind mapping)	
Subject-specific packages / apps (e.g. MyMaths, GIS)	
Existing databases or online simulations	
Virtual Learning environments - VLE (e.g. QOL, Moodle, iTunesU, EdModo)	
Hardware (e.g. Interactive Whiteboard, Apple TV, Google Chromecast)	

Questionnaire Items: Use of technology in teaching – Working with ITE students

Question Item	*Response Alternatives*
Put the following statements in rank order from (1) most important to (3) the least important	I use technology to model classroom practice in embedding technology in teaching and learning for my students I use technology with my students to enhance and deepen student learning (e.g. by connecting work in the classroom to wider societal issues) I embrace technology because I can see how it facilitates knowledge creation, productivity and an enthusiasm for lifelong learning.
I support didactic teaching of ICT skills.	Strongly Disagree Disagree Neutral Agree Strongly Agree
It is more valuable to use video-supported self-study training materials than face-to-face training	
Technology is best experienced via collaborative learning	
Independent learning of new technologies is difficult	

Questionnaire Items: Perceived value of technology in ITE teaching and learning – Classroom Practice and modes of Learning

Question Item	*Response Alternatives*
To support face to face collaboration within the classroom	Strongly Disagree Disagree Neutral Agree Strongly Agree
To improve student teachers' quality of work e.g. re-drafting	
To facilitate blended learning within the school	
To encourage future collaboration across schools	
To improve student teachers' exam results	
To accommodate student teachers' with additional or special educational needs	
To address the diversity of student teachers' in classrooms	

Questionnaire Items: Perceived value of technology in ITE teaching and learning – Reasons why ITE tutors promote ICT in ITE

Question Item	*Response Alternatives*
To allow student teachers to assess pupils' ICT capability in their subject	Strongly Disagree Disagree Neutral Agree Strongly Agree
To prepare student teachers for employment	
To allow student teachers to support others in the teaching community	
To change how student teachers, see the world e.g. cultural, religious difference	

Questionnaire Items: Perceived value of technology in ITE teaching and learning – Reasons why ITE tutors develop students' ICT skills

Question Item	*Response Alternatives*
To allow student teachers to assess pupils' ICT capability in their subject	Strongly Disagree Disagree Neutral Agree Strongly Agree
To prepare student teachers for employment	
To allow student teachers to support others in the teaching community	
To change how student teachers, see the world, e.g. cultural, religious difference	

Questionnaire Items: Perceived value of technology in ITE teaching and learning – How ITE tutors obtain ICT professional development

Appendix B

Question Item	*Theme*
Can you tell us how your students benefit from the use of ICT in your practice?	Value of technology in ITE teaching and learning
Why do you choose applications and for what purpose?	Use of technology in ITE teaching and learning
Would PME students be able to use these applications on school placement?	Use of technology by students on School Placement
Would they be expected to write a review of such a lesson as part of their portfolio?	Assessment of technology by students on School Placement
If they are assessed, what criteria are used?	Assessment of ITE students use of technology on School Placement
In general, what are the key ideas about how you approach ICT with the students?	Value of technology in ITE teaching and learning
In general, what are the key ideas about how you approach ICT with the students?	Use of technology in ITE teaching and learning
What kind of challenges do you encounter when putting these ideas into practice? (prompts; tech support, access to hardware/software; time; perceived priority	Challenges and Supports
Would there be occasions when ICT would be used to support shared education; if so give examples, if not why not?	Collaboration
How important do you think it is for your students to have very good ICT understanding and competence?	Value of technology in ITE teaching and learning
Are there any other issues that you would like to discuss on Teacher education tutors use of ICT that have not been discussed above?	

Interview Schedule

Conference Dissemination

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